RANGLE

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ABSTRACT. The historical background of the use of rangle by raptors is outlined and compared with the use of gastroliths by certain other carnivores, such as seals. Some possible functions of gastroliths are summarized. Observations of rangle stones in wild New Zealand Falcons (*Falco novaeseelandiae*) are described. The relevance of rangle to modern raptor management techniques is discussed.

Introduction

The use of rangle by raptors has long been established in falconry circles. The origin of this knowledge is not clear, but it probably derives from observations of captive birds because some captive falcons will voluntarily pick up stones of the appropriate size and swallow them. Latham (1615) fed 16 rangle stones to a Peregrine (*Falco peregrinus*). She cast them the next day. When the stones were washed and replaced near the falcon's block, she swallowed about a dozen of them every day for a month. Harting (1898) observed a similar occurrence in a captive Peregrine tiercel. He also believed that Merlins (*Falco columbarius*) which ate their food on fine gravel had a more healthy and lively appearance than those which ate their food on turf.

The function of rangle has not been fully investigated, but falconers (e.g., Michell 1900, Blaine 1936) generally agree that it stirs up grease and mucus lining the anterior digestive tract as far as the gizzard. My observations indicate that some of the mucus is cast up on the stones, and some is loosened and passes through the gut, discoloring the mutes and giving them an oily appearance for a day or two. It appears that the stones loosen mucus more effectively than any pellet-forming material because they are heavier and can grind together. Blaine considered that pebbles about 20 mm in diameter are suitable for a female Peregrine. Smaller smooth stones down to about 4 mm were considered best for a male Merlin. He suggested using rangle for 7-10 days, occasionally missing a day, on fat hawks after the molt, on taking up from hack, or when the bird is dull and sluggish. He also stipulated that rangle should be given only when the hawk is empty of casting. Falconers from the dry Eastern countries make no reference to rangle. It may well be that desert falcons, constantly swallowing sand and grit with their food, seldom require supplementary stones.

Falconers of old Europe were aware of the main facts concerning rangle, but most modern falconers have ceased to use it, being unfamiliar with its administration and effect. Latham's (1615:23) well-known adage is seldom adhered to:

> Wash'd meat and stones maketh a hawk to flie,
> But great casting and long fasting maketh her to die.

Although the use of rangle in captive raptors is well documented, I have been unable to find any scientific references to its use by wild raptors. Stones, or gastroliths, have been found in the gizzards of nesting cormorants (*Phalocrocorax* spp.) and divers (*Gavia* spp.), but the function of stones in these species has not been investigated. It is possible that the gastroliths perform the same function as rangle in raptors.

Many workers have observed gastroliths in various seals, sea lions, and crocodiles and have conjectured on the significance of the stones. Fleming (1953) described how gastroliths were cast up by sea lions (*Zalophus hookeri*), often accompanied by indigestible food remains. Substantial deposits of gastroliths, some from distant sources, have thus accumulated on the Snares and Auckland Islands. Dr. Falla (pers. comm.) observed that gastroliths cast up by the New Zealand fur seal (*Arctocephalus forsteri*) were occasionally covered with a layer of mucus, sometimes in considerable quantities. It appears that seals and sea lions retain the stones much longer than do raptors, perhaps for several weeks. However, Schroeder (1935) noted that large numbers of pebbles were removed from the floor of zoo tanks by sea lions and seals soon after feeding, and a few hours later the stones reappeared in their former abundance on the tank floor, apparently having been regurgitated after the food had been digested.

Emery (1941) summarized some of the theories about the function of gastroliths in seals and sea lions:

1. The stones may serve as ballast to aid in diving.
2. They may act as "gastric chewing gum" to prevent atrophy of the male's stomach during the long period of fasting.
3. They may crush worms infesting the stomach or alleviate ulcers.
4. They may triturate (grind up) food particles.

The last theory, trituration, appears to be the most valid one for seals. Gizzard stones have long been known to be used for trituration by herbivorous birds, but it seems unlikely that raptors swallow stones for this reason. Sharp sand is an old remedy for the treatment of intestinal worms in raptors.

Field Observations

Recently I have been involved in a study of the New Zealand Falcon (*Falco novaeseelandiae*). In the 1974 breeding season I examined plucking posts near about 10 nests, searching for prey remains, castings, mutes, and molted feathers. I mentally rejected any nonbiological material. Then, early in the 1975 breeding season, I came across a classic case of rangle: about nine small pebbles on the top of a rock used as a perch by the falcons. After the discovery, rangle was included in my "searching image," and I found numerous examples, always in association with falcon perches.

Female New Zealand Falcons, weighing 450-660 g, produce rangle stones about 15 mm diameter, weighing 17-20 g per group (figure 1A, B). Stones of this size are not easily blown away and appear to remain for considerable periods. One or two examples had lichen growing on them. Males, weighing 260-350 g, produce smaller stones, about 7 mm diameter (figure 1C) and weighing about 8-10 g per group. These stones are more easily lost, and the only examples found in the wild were some that had fallen onto moss. The stones were readily recognizable because they were all water-worn to some extent, thus contrasting strongly with the rough, fragmented surface of the perch rock (figure 1E). Often, too, they were of a different color from the rocks nearby. All examples were found on plucking or hunting perches in the open. Most roosts had a vertical drop below, and rangle would be lost; similarly rangle cast onto vegetation is quickly lost.

Pellet Analysis

Analysis of about 600 pellets to date has not revealed any significant quantity of rangle. Each of two pellets contained about 15-19 small stones (figure 1D), but they were considerably smaller than true rangle stones and could well have been in the gizzard of prey.

It seems likely that wild falcons take stones only after they have cast all pellet-forming material. For example, a crop resulting from an early morning kill could be digested and the pellet cast by evening, while there was still sufficient daylight for the falcon to obtain rangle from a creek. My experiments in supplying rangle to trained falcons have always confirmed Blaine's description, but I have not risked feeding casting and rangle together.

Discussion

The factors which stimulate wild falcons to take rangle would be very difficult to elucidate in the field. Certainly the stones selected by a particular bird are remarkably uniform. Also, the frequency with which wild falcons make use of rangle is not known. In the pairs studied, the adults were present on territory all year for periods of many years, so it is difficult to evaluate how often they cast rangle. As far as I can tell, a haggard female of a pair of aviary birds has used rangle at least twice in the last twelve months.

One thing does seem certain: aviary birds, especially captive breeding stock, cannot fail to benefit from having appropriate stones available to them at all times. Leading an inactive, well-fed existence, they have rangle requirements almost certainly higher than those of wild birds. There have been cases of captive hawks dying from diets containing too high a fat content, such as adult pig meat or fat moorhens (*Gallinula chloropus*); a few timely doses of rangle could perhaps have saved these hawks. Rangle may also have a place in preventive therapy of foot troubles in lethargic and sluggish raptors.

I would be most grateful for any observations or information on rangle, especially in wild raptors.

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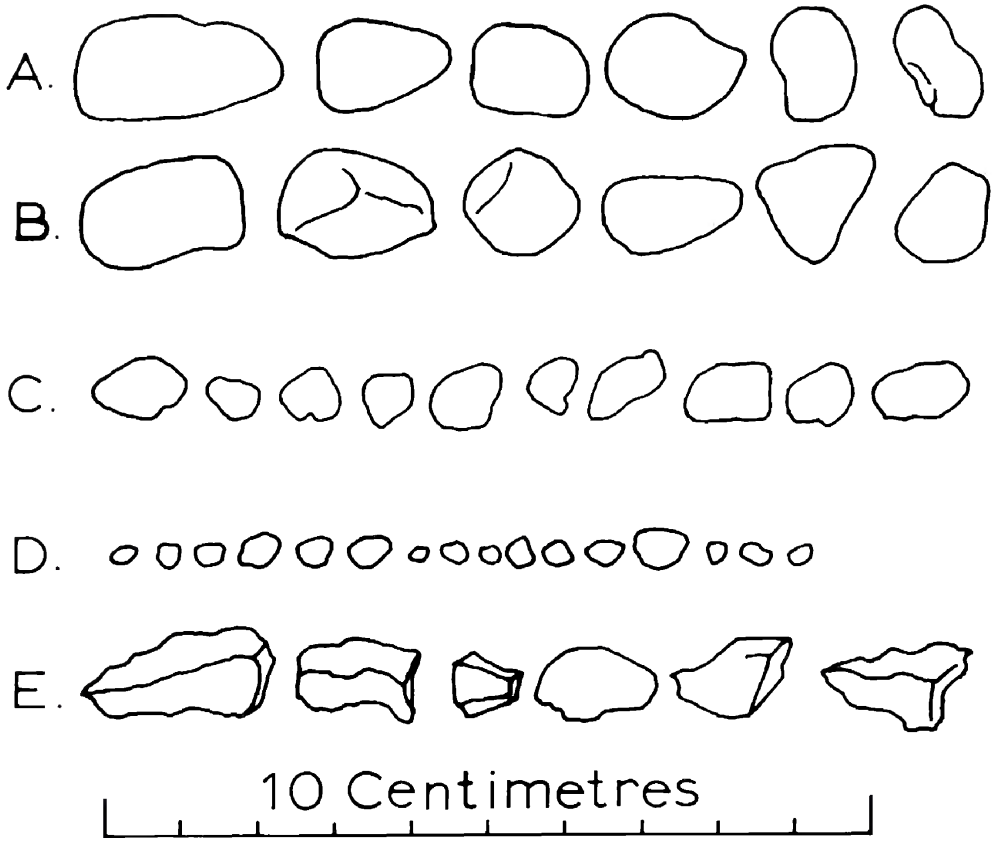

Figure 1. Rangle from New Zealand Falcons.
A. Female rangle. Sweet Stream pair, Marlborough. 1975
B. Female rangle. Byron Creek pair, Marlborough. 1975.
C. Male rangle. Byron Creek pair, Marlborough. 1975.
D. Stones found in a casting. Waikene Hills, Kaikoura. 1974.
E. Control: typical rock chips. Byron Creek area, Marlborough. 1975.